WireFinder 9000

Written By: Terry Noe

PARTS:

- Junction diode (1)
  part reference D1 in schematic. All parts are available from Mouser Electronics (mouser.com).
- LED (1)
  D2
- Battery connector (1)
  J3
- Transistor (1)
  Q1
- Potentiometers (2)
  Mouser #652-3386H-1-502LF, R1-R2
- Switch (1)
  SW1
- Hex inverter (1)
  Mouser #511-4069U, U1
- XOR gate (1)
  Mouser #511-4070, U2
- Capacitors (5)
  C2, C4-C6, C8
- Capacitor (1)

C1

- Capacitor (1)
  C3
- Capacitor (1)
  C7
- Sockets (2)
- Banana jacks (2)
  red J1 and black J2
- resistors (2)
  R3, R9
- resistors (2)
  R10, R11
- Resistor (1)
  R4
- Resistor (1)
  R5
- resistors (2)
  R6, R8
- Resistor (1)
  R7
- resistors (2)
  R12, R13
- Project enclosure (1)

SUMMARY

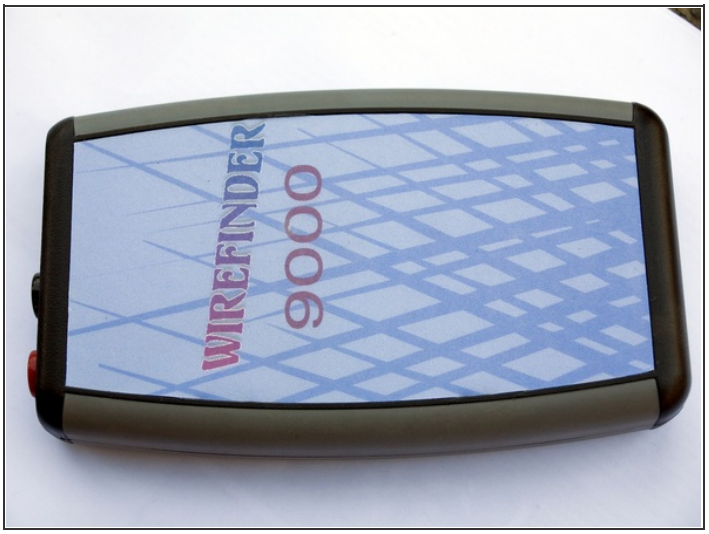
By Christie, Jim, John, and Terry Noe

Our dog, Maggie, loves to run around in our big yard. But how do we fence her in? Building a 500-foot fence is expensive and unsightly, so we use an “invisible fence.” This is a buried wire that runs around the edge of our yard. Maggie wears a radio collar that beeps when she gets close to the wire, or gives her a mild shock if she strays over the edge (it doesn’t hurt).

One of Maggie's favorite sports is digging up the gophers that are endemic to our neighborhood. Unfortunately for us, the gophers have a hobby of their own, which is biting through the buried wire of our invisible fence.

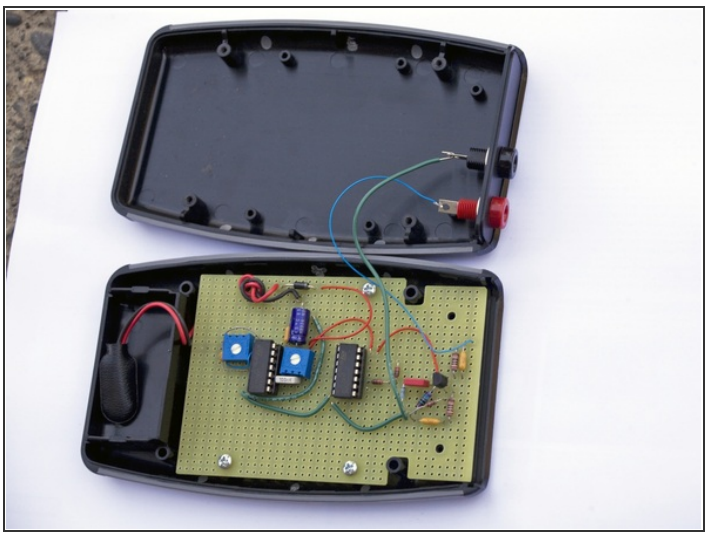
How do you find a break in a 500-foot buried wire? Digging up the entire 500 feet would not be fun. You can buy commercial cable finders that will find buried wires and wire breaks, like the Armada Technologies Pro 700, but these cost from $500 to $2,000! We decided to make our own and use the money we saved for something useful, like building a big trebuchet.

Step 1 — Here's how it works.



- Our WireFinder 9000 has 2 components: a transmitter that puts a radio signal on the buried wire, and a radio receiver. You connect the transmitter to one end of the buried wire. This causes a current to flow through the wire, which creates a radio signal that radiates from the wire. Then you can find the wire by walking around with the radio receiver.
- When the receiver is close to the buried wire, the radio signal is strong and you can hear it over the receiver's speaker. The strength drops rapidly as you move away from the cable, causing the signal to drop in volume until it becomes inaudible.
- If there's a break in your wire, the current can't reach the isolated segment. So when you move past the break, the signal level drops off rapidly. Using the WireFinder, we were able to locate the break in our wire quite accurately: the place we started digging was only 2 feet from the break.
- This technique works for finding both simple wires — like our invisible fence — and buried coaxial cables as well.
- To keep things simple and cheap, we chose a regular AM radio as the receiver. Then we designed our transmitter to generate a signal of the right frequency and modulation type so that an AM radio can pick it up. Fortunately, the AM radio band is very low-frequency, which makes construction and wiring very simple. The total cost of the transmitter is about $35.

Step 2 — Construct the WireFinder.



- Build the transmitter circuit as shown in the schematic diagram. Standard wiring and construction techniques can be used. Because AM radio operates at a relatively low frequency, high-frequency construction techniques, such as controlled-impedance lines or coaxial cables, are not required. The second photo shows how we arranged the components on the protoboard.
- There are 2 adjustments you can make in the transmitter circuit. Potentiometer R1 controls the transmit frequency, and potentiometer R2 controls the pitch of the tone you hear on your AM radio.
- First, center both pots in the middle of their adjustment range. Tune your AM radio to a vacant frequency at the low end of the tuning range (we chose 574kHz) and place it near the transmitter. Now adjust R1 while listening to the radio. When you tune the transmitter to the same frequency, you'll hear a constant tone in the speakers.
- Adjust R2 to change the pitch of the tone to whatever you prefer; we tuned ours to 800Hz.

Step 3 — Use the WireFinder.

- To find your buried wire, connect one end of the wire directly to the red terminal, J1, on the WireFinder. You might find an alligator clip convenient. If you're trying to find a buried coaxial cable, connect J1 to the outer braid or shield of the coax.
- Connect the black terminal, J2, to earth ground. The easiest way is to drive an aluminum tent stake into the ground, and connect J2 to the stake. Don't use a painted stake; the paint will prevent you from making an electrical connection. If your soil is very dry, you can improve your ground connection by watering the soil around the stake.
- Turn your AM radio on and tune it to the frequency of the transmitter. Holding it close to the wire, you should be able to hear the tone. Now you simply follow the wire using the AM radio. If the signal level drops, you've either strayed from the wire path or you've passed the break in the wire.
- Eventually, as you follow the wire, you should reach a point where the signal strength drops off in every direction except back the way you came. Now get out your shovel and start digging. The break in the wire should be nearby.

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